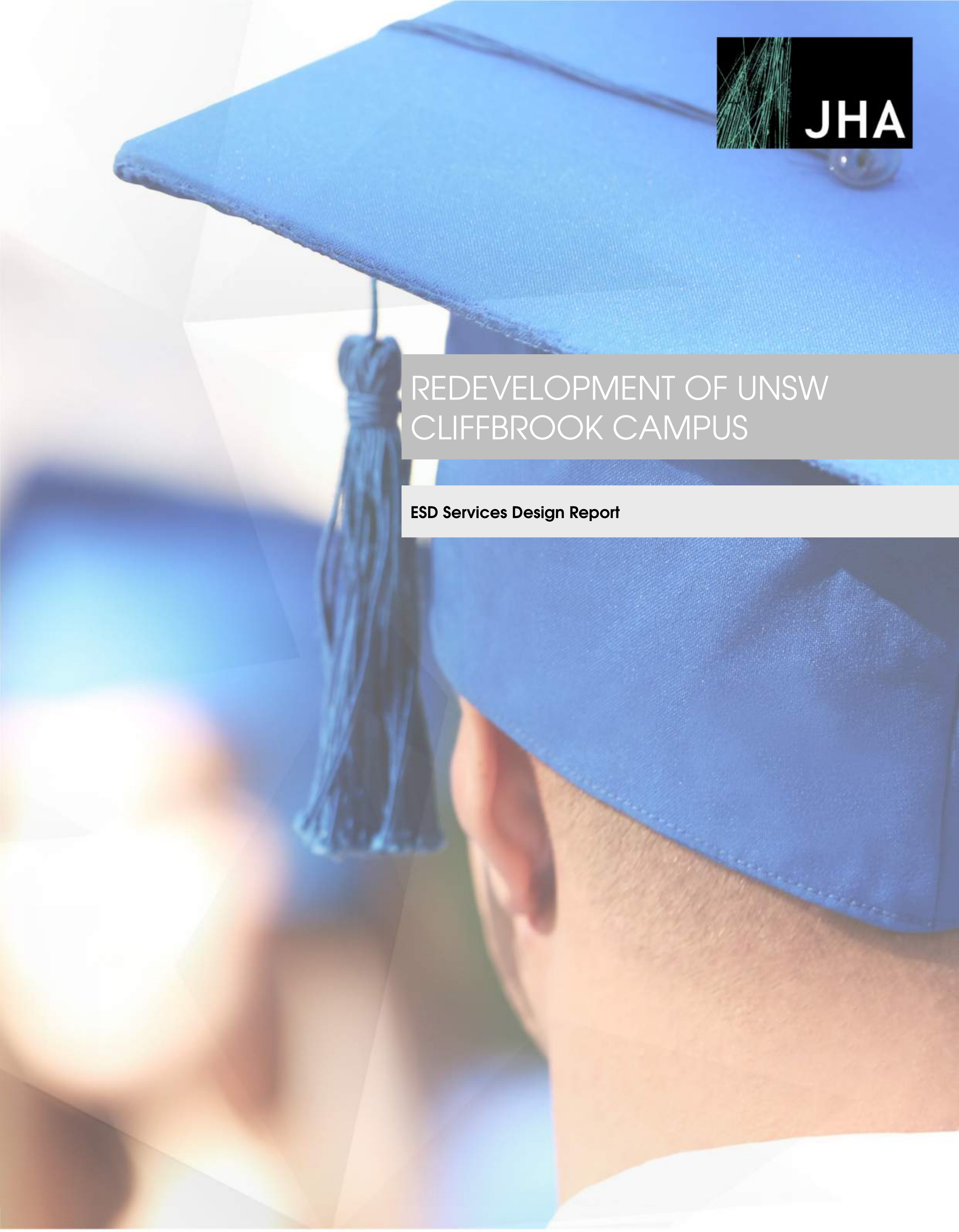

REDEVELOPMENT OF UNSW CLIFFBROOK CAMPUS

ESD Services Design Report

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1. EXECUTIVE SUMMARY

This report has been prepared by JHA to identify and summarise the proposed Ecologically Sustainable Design (ESD) initiatives which have been incorporated into the design of the proposed Redevelopment of UNSW Cliffbrook Campus project.

This report demonstrates compliance with the Secretary's Environmental Assessment Requirements (SEARS) which apply to the project and has been prepared to accompany a State Significant Development Application to the NSW Department of Planning and Environment. This report should be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the application.

The report identifies how the principles of Ecologically Sustainable Design (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and on-going operation phases of the development.

2. INTRODUCTION

2.1 Project Description

The University of NSW (UNSW) is seeking to redevelop its satellite Cliffbrook Campus located in Coogee, to provide a new purpose built accommodation (50 x participant bedrooms, 2 x staff bedrooms and 1 x on-site manager) and educational facility with teaching/ conferencing components.

The primary function of the new facility will be to accommodate the executive residential programs which are run by the Australian Graduate School of Management (AGSM), but it will also be used for additional executive education programs as well as UNSW faculty retreats and external conferencing.

The Cliffbrook Campus is located on the corner of Battery and Beach Streets in Coogee, with ocean views over nearby Gordon's Bay. The site currently consists of four buildings – two of which are heritage listed and will be renovated under the proposed redevelopment (CC1 [Cliffbrook House] and CC3 [Cliffbrook house garage]), and two which are flagged for demolition and redevelopment under the endorsed scheme proposal (CC2 and CC4) to be redeveloped as CC4—the new accommodation building.

We understand that a key component of this project will be defining the participant experience, and as such UNSW intends to develop the site in-keeping with a '4-star' standard of amenity, with the following criteria considered critical to achieving this:

- Food services
- Views
- Amenities (e.g. gym facility)
- Ease of access
- Parking

The AGSM is currently housed within the AGSM Building (G27) on the upper Kensington Campus however this building is now dated and in need of significant refurbishment to bring it up to the quality on offer by UNSW's main domestic competitors in this market.

2.2 Secretary's Environmental Assessment Requirements (SEARS)

This report acknowledges the SEARS prepared by the Secretary which notes the following in Section 6 of the document:

6. Ecologically Sustainable Development (ESD)

1. *Detail how the ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the development.*
2. *Demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.*
3. *Include a description of the measures that would be implemented to minimise consumption of resources, water (including water sensitive urban design) and energy.*

Items 1, 2 and 3 of the SEARS requirements are addressed in sections 3, 4 & 5 of this report respectively.

3. PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The principles of Ecologically Sustainable Development as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 have been incorporated into the design and on-going operation phases of the development as follows:

3.1 The Precautionary Principle

Namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

- *(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and;*
- *(ii) An assessment of the risk-weighted consequences of various options.*

Project response:

The Redevelopment of UNSW Cliffbrook Campus project is being designed in accordance with the UNSW's Sustainability Objectives Framework, found in Appendix A, which is a holistic assortment of ESD initiatives that address a wide range of design, construction and operational goals. This framework will ensure that the development minimises the impact on the environment in the areas of energy, water and materials. A strong focus on electrical and mechanical requirements, including the use of renewable energy contributes to significant strides toward minimising climate change impacts.

3.2 Inter-generational equity

Namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations

Project response:

This is a previously developed site that currently consists of four buildings – two of which are heritage listed and will be renovated under the proposed redevelopment (CC1 [Cliffbrook House] and CC3 [Cliffbrook house garage]), and two which are flagged for demolition and redevelopment under the endorsed scheme proposal (CC2 and CC4). During the development process and in accordance with University and legislative requirements, the team will follow a construction environmental management plan as well as a construction waste management plan.

3.3 Conservation of biological diversity and ecological integrity

Namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration

Project response:

A site inspection was undertaken by Narla Environmental to consider the potential for development. The ecological survey and assessment were undertaken in accordance with relevant legislation, namely the *Environmental Planning & Assessment Act, Threatened Species Conservation Act, Environmental Protection & Biodiversity Conservation Act,* and the *Fisheries Management Act.* A 7-part test of significance was prepared in accordance with Section 5A of the EP&A Act and concluded that the proposed development will not have a significant impact on any threatened species, populations or endangered ecological communities. No threatened fauna species, flora species and no endangered ecological communities listed under the *Biodiversity Conservation Act* were recorded within or in close proximity to the subject site.

3.4 Improved valuation, pricing and incentive mechanisms

Namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

Project response:

The design of this development has considered whole of life costs rather than capital expenditure only to determine the optimum strategy with regard to major building components. This includes decisions made regarding the following:

- Envelope
    - Roof
    - External Walls
    - External Doors
    - External Windows
- Vertical Transport—Passenger Lifts
- Lighting and Controls
- Electricity Supply
- Standby Generator
- Mechanical Installations
- Metering
- Domestic Hot Water
- Taps & Fittings
- Materials Selection

4. UNSW SUSTAINABILITY OBJECTIVES FRAMEWORK

This development is being designed in accordance with the UNSW's Sustainability Objectives Framework, found in Appendix A, which is a holistic assortment of ESD initiatives that addresses a wide range of design, construction and operational goals. This framework will ensure that the development minimises the impact on the environment in the areas of energy, water and materials. A strong focus on electrical and mechanical requirements, including the use of renewable energy contributes to significant strides toward minimising climate change impacts.

The aim of the objectives is to encourage a balanced approach to designing new university projects; to be resource efficient, cost-effective in construction and operation, and deliver enhanced sustainability benefits with respect to impact on the environment, the health and well-being of students, staff and visitors whilst providing the best possible facilities for a constructive learning experience.

Initiatives are arranged into the following categories:

- Management
- Envelope
- Electrical Installations
- Mechanical (HVAC) Installations
- Lighting
- Water
- Materials
- Waste
- Sustainable Transport

This report has been structured to summarise the sustainability initiatives selected for the Redevelopment of UNSW Cliffbrook Campus project. The full list of UNSW sustainability targets can be found in Appendix A.

5. ECOLOGICALLY SUSTAINABLE DESIGN (ESD) INITIATIVES

5.1 Introduction

This development will implement a holistic and integrated approach to Ecologically Sustainable Design (ESD), maximising passive opportunities with the selective application of modern technology where appropriate.
Initiatives will be chosen with due regard to whole of lifecycle cost benefits to the University.

The ESD initiatives and targets outlined within this document have been compiled based on the following:

- Best practise design principles
- BCA/NCC Section J – Energy Efficiency Targets (i.e.: exceeding targets)
- UNSW Cliffbrook Campus Sustainability Targets

5.2 Management

The CCR project is committed to achieving sustainability outcomes in the design and construction phases, as well as in operation.

5.2.1 Green Star Accredited Professional

All members of the design team are experienced in delivering sustainable outcomes for engineering services packages and the design process shall be overseen by a Green Star Accredited Professional to provide advice on achieving the sustainability targets of the project.

5.2.2 Comprehensive Commissioning

Comprehensive commissioning procedures shall ensure that all buildings are operating efficiently in accordance with the design intent and will be carried out in line with the University's design guideline.

5.2.3 Building User's Guide

All relevant information about the design and correct operation of the buildings' environmental features will be transferred to the occupants via the Building Users' Guide. This applies to all buildings.

5.2.4 Public Displays

Should the university wish to communicate any ESD initiatives incorporated into the CC4 building; the provision of a public information display can be further considered in the next stage.

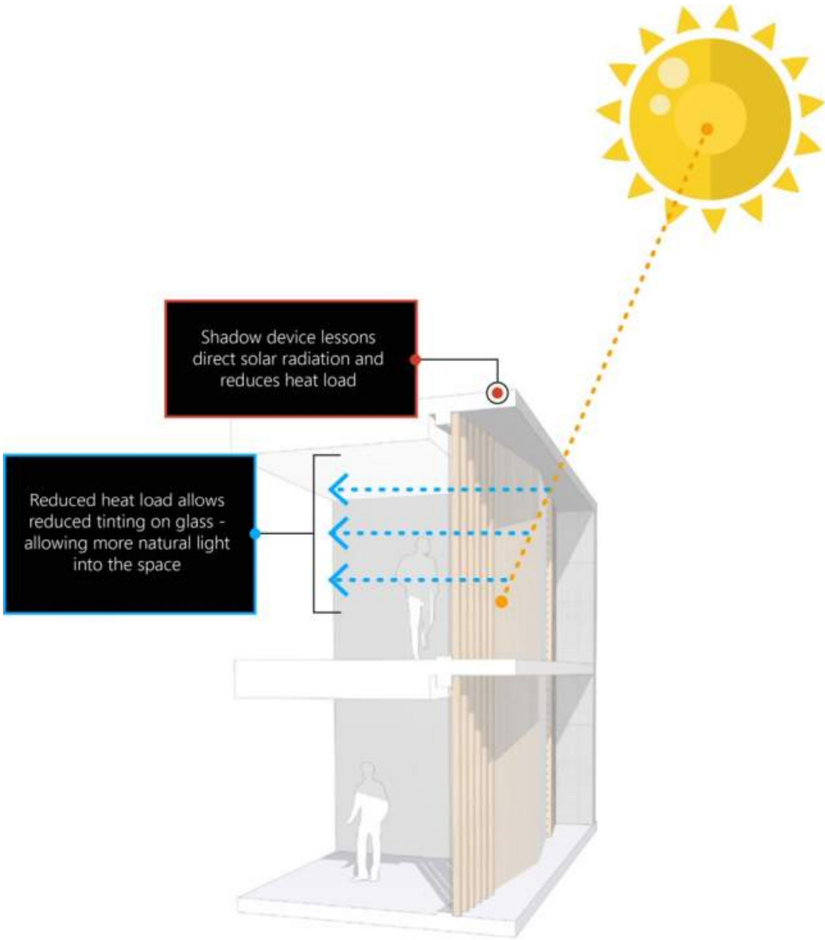
5.3 Envelope

5.3.1 Building Fabric Performance

The CC4 building fabric will be designed to meet the thermal and sealing performance of the BCA Section J requirements. Thermal breaks will be incorporated into façade elements of walls and windows.

5.3.2 Shading and Daylighting

The CC4 building orientation is such that there is a significant amount of south facing glazing, allowing for increased natural daylight whilst minimising unwanted passive solar heat gain. The shading scheme for the building facilitates the application of glazing while mitigating extra heat loads and glare and cutting tinting treatment requirements that reduce natural light transmission. These passive design features allow for enriched daylighting and greater access to external views for occupants. Additional daylighting reduces the reliance on artificial light and benefits alertness, mood and productivity. External views provide a connection to nature and the campus environment and also help to create an environment encouraging constructive learning.



Proposed Shading Device to Reduce Solar Heat Load and Increase Daylighting

5.4 Electrical

5.4.1 Demand Management

The CC4 building will utilise BMS controls that incorporate load shedding of the air-conditioning systems, preconditioning and floating set point control algorithms to reduce peak energy demand. The air conditioning system can precondition the building during off-peak periods and reduce its load or switch off throughout peak energy demand periods, whilst still maintain comfort conditions. Floating set point controls will allow wider temperature set points for the air conditioning system in peak energy periods in appropriate spaces to reduce load on the mechanical plant.

5.4.2 Metering

Electricity metering and sub-metering shall be specified in accordance with the University's Electrical, Hydraulic and Mechanical standards to monitor and manage electricity consumption in the CC4 building.

5.5 HVAC

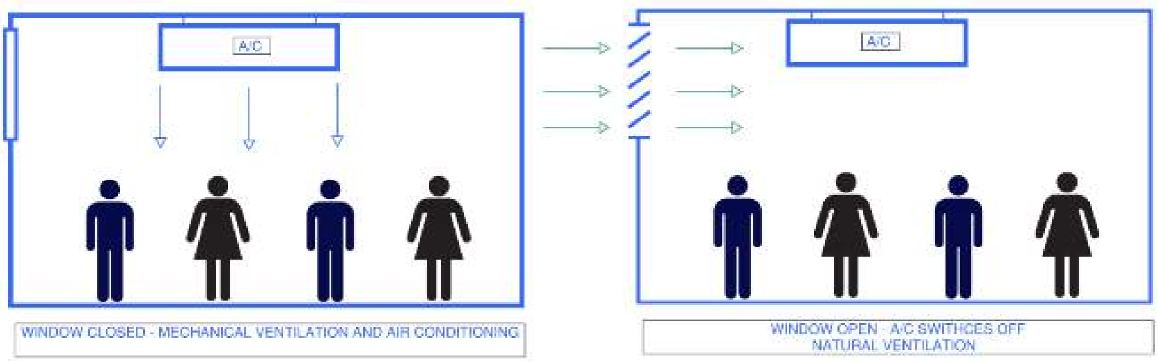
The mechanical systems within the development will maintain internal space conditions for a range of variables including temperature, air velocity and noise level to deliver a comfortable indoor environment for occupants. This reduces temperature fluctuations, draft, and plant noise and allows participants to focus on learning.

5.5.1 Wide Setpoint Control Deadband

Seasonal setpoints are typically set as Cooling 24º +1 and Heating 21º-1 which translates to a 22.5ºC control setpoint with a 3º deadband (21-24ºC) and a 1º proportional control band above and below. This allows a reasonably wide range for the buildings to operate in free-running mode with no artificial heating or cooling necessary.

5.5.2 Mixed Mode AC

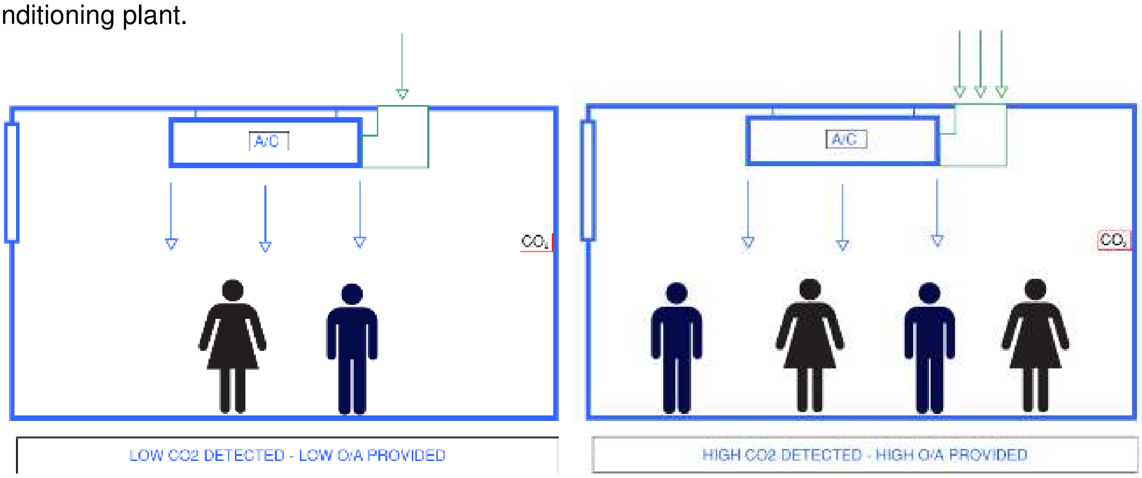
The air conditioning in CC1 and CC2 will function in a mixed mode ventilation arrangement. Reed switches will detect when the windows are open and deactivate the air conditioning serving that space. In this mode the space will be naturally ventilated reducing the air conditioning energy consumption.



Typical Window Interlock Operation

5.5.3 CO2 Monitoring

CO_2 monitoring and ventilation controls will be incorporated in areas with variable occupancy, such as teaching rooms, to modulate the ventilation rates of internal spaces to match the population. This will supply the optimum quantity of fresh air to maintain air quality and avoid unnecessary loads on air conditioning plant.



Typical CO2 Monitoring Strategy

5.5.4 Dedicated HVAC Plant for 24/7 Spaces

Spaces that require 24/7 operation of the HVAC systems will be considered for dedicated plant to enable out-of-hours shutdown of the main plant, e.g. server rooms.

5.6 Lighting

5.6.1 Lighting Control

Lighting in the CC4 building is to be controlled by Presence Detection (PD) and Photo Electric (PE) methods typically depending on the application. Lighting is to have an FM accessible master controller to adjust system parameters globally and zone by zone. Closed spaces such as offices and cleaner's cupboards are to also have a wall switch. Voltage control (dimming) should be provided where appropriate.

5.6.2 Energy Efficiency

Lighting in all buildings is to achieve a minimum 15% improvement over BCA Section J6 lighting power density allowances (W/m^2), mainly through the use of LEDs.

5.7 Water

5.7.1 Centralised Solar Hot Water

Centralised solar hot water (SHW) systems with gas boost, energy efficient appliances, appropriately zoned and intelligent lighting and AV controls shall further reduce energy consumption and peak power in the CC4 building.

5.7.2 No Hot Water to Restrooms

To further reduce the energy consumption associated with hot water, limited hot water will be provided to public restroom wash basins for the all buildings.

5.7.3 High Efficiency Fixtures

Water consumption in all buildings shall be reduced by incorporating water efficient fixtures and fittings in accordance with the University Hydraulic Design Standard.

5.7.4 Rain Water for Non-Potable Uses

Rain water will be captured from the CC4 building roof and used for toilet flushing and any other non-potable uses such as irrigation within the development.

5.8 Renewables

5.8.1 Solar Photovoltaics

Solar Photovoltaics will be considered for the development with an aspirational target of generating approximately 10% of annual energy consumption. This is to be further developed and optimised throughout the design phase. The amount of combined roof area required to reach this goal is approximately 400 square metres.

5.9 Materials

5.9.1 Low VOC / Low Formaldehyde Materials

Adhesives, sealants, flooring and paint products will be selected to contain low or no Volatile Organic Compounds (VOCs) and all engineered wood products used in exposed or concealed applications are specified to contain low or no formaldehyde to avoid harmful emissions that can cause illness and discomfort for occupants. This applies to all buildings.

5.9.2 Recycled Content

Loose furnishings within the building shall be selected based on their recycled content, end-of-life recyclability and product stewardship agreements. By selecting loose furnishings which comply with independent environmental certification, for example Ecospecifier or Good Environmental Choice Australia, the project will confidently reduce environmental impacts and waste from furnishings over the life of the building. This applies to the entire development.

60% by mass of all steel shall have a post-consumer recycled content greater than 50% or be reused steel. Sustainable timber shall be specified for at least half of the timber products used on the project. Recycled concrete shall be specified using recycled aggregate or manufactured sand and reduced quantities of Portland cement to reduce environmental impacts of concrete production and embodied energy. This applies to the CC4 building.

5.10 Waste

During the construction phase of the project at least 80% of demolition and construction waste shall be recycled.

Centralised waste and recycling bin systems shall be provided for the buildings during operation as well as a dedicated storage area for the separation and collection of recyclable waste.

5.11 Sustainable Transport

5.11.1 Encourage Alternative Transport

The project promotes and caters for sustainable and alternative transport options. Bicycle parking and a shower facility shall be provided for staff and participants in the CC4 building, in accordance with the UNSW Sustainability Objectives. Car parking within the campus shall be limited to the minimum requirements.

5.11.2 Vertical Transport

The use of lifts within the development will be discouraged by providing visually prominent staircases for distance of up to 4 floors plus basement.

Lifts will be assessed to determine the economic viability of energy recovery.

6. INTEGRATED WATER MANAGEMENT PLAN

6.1 Potable Water supply demand

The potable water demand for the buildings has been estimated at an average of 19.1kL per day (refer Warren Smith & Partners Infrastructure Management Plan). This will be supplied entirely from the mains supplies fronting Beach Street and Battery Street.

6.2 Alternative Water Supplies

A feasibility study was performed by Warren Smith & Partners into the potential use of rainwater harvesting to provide an alternative water source on site for non-potable uses such as irrigation and WC flushing. Due to the low reliability of the supply and the constraints on locating storage tanks on the development it was deemed as unsuitable as a supply for WC flushing, but feasible for landscape irrigation. Rainwater storage tanks will be incorporated into the development and connected to the roof water downpipes

6.3 Water use reduction initiatives

6.3.1 High Efficiency Fixtures

Water consumption shall be reduced by incorporating water efficient fixtures and fittings in accordance with the University Hydraulic Design Standard.

6.3.2 Water Sensitive Urban Design (WSUD)

The landscaping of the site has been designed with best practice WSUD principles in mind. The following initiatives have been included to ensure the development has a minimal requirement for irrigation of the landscaping from potable water sources:

Paved areas have been sloped to facilitate surface water recharge to mass planting beds to provide improved irrigation efficacy during low rainfall events.

Appropriate shade planting has been selected to improve air quality and reduce the urban heat island effect, further minimising localised evaporation of water held in the soil.

Where possible the landscaping is comprised of hardy, low water use, indigenous plant species suited to the harsh urban environment which will thrive without the need for irrigation other than natural rainfall.

Where necessary water-efficient subsoil drip irrigation systems are proposed to ensure that the landscape is maintained to the high standard required. These will be supplied by the rainwater harvesting system to minimise potable water consumption.

7. COMPARISON AGAINST INDUSTRY BENCHMARK RATING SCHEME

7.1 Green Star Design and As-Built V1.1

This project is not pursuing an accredited Green Star rating, however many of the initiatives proposed are based on or share similarities with credits in the Green Star Design and As-Built rating tool.
For the purposes of comparison the following table has been prepared which outlines where the sustainability initiatives which have been incorporated into this project are recognised by the Green Star Design and As-Built V1.1 tool.

No.	Initiative	Green Star Design and As-Built V1.1	
		Recognised	Credit Reference
10.2.1	ESD Professional	✓	1
10.2.2	Environmental Management Plan	✓	7
10.2.3	Commissioning and Building Tuning	✓	2
10.2.4	Building Users Guide	✓	4
10.2.5	Public Information Display		
10.3.1	Building Performance Improved by 15%	✓	15
10.3.2	Infiltration		
10.3.3	Shading and Daylighting		
10.4.1	Demand Management	✓	16
10.4.2	Metering	✓	6
10.5.1	Wide Setpoint Control Deadband		
10.5.2	Mixed Mode AC		
10.5.3	CO2 Monitoring	✓	9.2
10.5.4	Dedicated AC for 24/7 Areas		
10.6.1	Lighting Control	✓	27
10.6.2	Lighting to achieve 15% improvement over BCA J6	✓	11.1
10.6.3	Obtrusive Lighting	✓	27
10.7.1	Hot Water Systems		
10.7.2	No Hot Water in Public Restrooms		
10.8.1	Solar Photovoltaics		
10.9.1	High Efficiency Fixtures	✓	18
10.9.2	Rainwater Harvesting	✓	18
10.10.1	Low VOC & Formaldehyde Materials	✓	13.1 & 13.2
10.10.2	Recycled Content	✓	21, 20.1
10.11.1	Construction & Demolition Waste		
10.11.2	Waste Storage and Sorting	✓	8B.1 & 8B.2
10.12.1	Alternative Transport	✓	17B.2 & 17B.4
10.12.2	Vertical Transport		

8. ESD INITIATIVES SUMMARY TABLE

The proposed initiatives are listed below in summary:

Category	Initiative	Component Affected	Benefit	Buildings Affected
Management	GSAP	Design	Accredited professional ESD consultant to aid design team	All
	Comprehensive Commissioning	Commissioning of services	Services more likely to be commissioned properly and run as per the design intent	All
	Building Users Guide	Facility Management	Greater understanding of the buildings' environmental features will be transferred to the building FM team	All
	Public Displays	Occupants	ESD initiatives within the new accommodation building will be displayed at appropriate points to assist the occupants in maximising their benefit	CC4
Envelope	Building Fabric Performance exceed Section J by 15%	HVAC Energy Thermal Comfort	Exceeding section J minimum thermal performance requirements will provide a more comfortable and energy efficient building envelope	CC4
	External shading	HVAC Energy & Thermal Comfort	External shading will be optimised using computer simulation to improve the passive solar performance of the new accommodation building envelope	CC4
	Daylight Harvesting	Lighting Energy	Strategic use of vision glazing combined with light internal colours, light shelves and appropriate floor ratios will be used to maximise the availability of natural light inside the space	CC4
Electrical	Demand Management	Maximum Electrical Demand	BMS controls will enable the services to be manipulated during periods where the building is likely to reach or exceed the maximum demand. This will include load shedding and preconditioning of air conditioned spaces during periods of low demand. Reduced maximum demand can substantially reduce energy bills.	CC4
	Metering	Electrical and water consumption	Sub metering in accordance with the University standards will allow consumption to be monitored and reported on, and identify trends which require rectification.	CC4
HVAC	Wide setpoint deadband	HVAC energy consumption	Use of wide setpoint control deadbands enables the HVAC systems to operate without artificial cooling or heating for	All

			longer periods of time but without substantially affecting thermal comfort.	
	Mixed mode AC	HVAC energy consumption	Mixed mode AC allows spaces to operate under natural ventilation when conditions are suitable, but then make use of AC during extremes of temperature.	CC1, CC3
	CO_2 Demand Controlled Ventilation	HVAC energy consumption	CO_2 demand controlled ventilation will enable reduced outside air quantities to be delivered to spaces with reduced occupant numbers to avoid unnecessary heat loads associated with ventilation.	CC4
	Dedicated plant for 24/7 spaces	HVAC energy consumption	Using dedicated plant for continuously operating spaces such as comms rooms allows them to be sized more appropriately and avoid the main plant operating at a vastly reduced load outside of normal operating hours	CC4
Lighting	Automated lighting control	Lighting energy	Presence Detection (PD) and Photo Electric (PE) sensors enable lighting to be turned on only when necessary and avoid unnecessarily lit spaces.	CC4
	Lighting energy efficiency improved over BCA Section J by 15%	Lighting energy	Improved lighting efficiency will reduce the energy consumption of the lighting and also reduce internal heat loads leading to reduced HVAC energy consumption.	All
Hot Water	Centralised Solar HW	Hot water energy	Solar hot water heating will provide a renewable source of heating energy for the hot water system and reduce the consumption of gas or electricity to heat water.	CC4
	No HW to restrooms	Hot water energy	Providing hot water to restrooms is often pointless as the basins are rarely used long enough to heat up the water sitting in the dead legs, leading to hot water being heated that does not reach the user.	All
Renewables	Solar PV	Electrical energy	Solar PV to be provided with a target of reducing the overall energy consumption of the site by 10%	CC4
Water	High efficiency fixtures	Potable water use	High WELS rated fixtures will reduce potable water use.	All
Materials	Low VOC and formaldehyde materials	Indoor Environment Quality	Specifying low or no VOC and formaldehyde content in materials prevents these toxic substances which are commonly found in construction materials from being present within the building and causing harm to the	All

			occupants.	
	Recycled content in construction materials	Embodied energy and Landfill volumes	Using construction materials and furnishings which have a post-consumer recycled content to them reduces waste going to landfill and embodied energy of the construction materials.	All
	Recycling of construction waste	Landfill volumes	Recycling construction waste reduces the burden on virgin materials and reduces the amount of waste going to landfill.	All
Sustainable Transport	Bicycle parking and end of trip facilities	Fossil fuel use in transport	Encouraging cycling by providing secure storage and a shower facility reduces reliance on fossil fuel burning transport methods and reduces traffic congestion.	CC4
	Visibly prominent stairways	Lift energy	By providing visibly prominent stairs in a central location the occupants will be encouraged not to use the lifts for rises of only a few storeys.	CC4

9. APPENDIX A- UNSW SUSTAINABILITY OBJECTIVES

Sustainability targets noted below for all new developments and campus renewal projects.
Analysis of targets is required to ensure relevance.

OBJECTIVE	ELEMENT	COMPONENT	PARAMETER	PERFORMANCE	NOTES
1, 2	Envelope	Roof	Thermal transmission	BCA + 15% J1	
1, 2	Envelope	External Walls	Thermal transmission	BCA + 15% J1,2	
1, 2	Envelope	All	Building sealing	BCA + 15% J3	
1, 2	Envelope	External Walls	Thermal transmission		Thermal breaks to be incorporated into facade
1, 2	Envelope	External Doors	Outside air infiltration and loss of conditioned air		Main entrance doors and receptions designed to minimise infiltration and loss of conditioned air – revolving doors/airlocks/reduced areas and volumes for receptions
1, 2	Envelope	External Windows	Outside air infiltration and loss of conditioned air		Opening windows in external walls designed to minimise loss of conditioned air by use of interlocks with HVAC installation. Thermal breaks to be incorporated into frames.
1, 2	Envelope	External Walls	Solar shading		Preference is for fixed shading systems. Direct solar gain from east, north and west façades to be minimized from 1st September to March 31st
1, 2	Envelope	External Walls	Natural light		Optimise indirect natural lighting in offices and open areas
1, 2	Vertical Transport	Passenger Lifts	Energy recovery		Business case required to determine economic viability

OBJECTIVE	ELEMENT	COMPONENT	PARAMETER	PERFORMANCE	NOTES
1, 2	Vertical Transport	Passenger Lifts	Energy saving		Discourage use between fewer than 3 floors
1, 2	Electrical Installations	Lighting to non-laboratory spaces	Controls		Use of PD and PE to control lighting. Lighting control to have FM accessible “master” controller to adjust system parameters globally and zone by zone. Closed spaces (e.g. offices and cleaners cupboards) should also have a wall switch
1, 2	Electrical Installations	Lighting to non-laboratory spaces	Energy saving		Lighting should have voltage control units where appropriate
1, 2	Electrical Installations	Lighting to non-laboratory spaces	W/m2	BCA + 15% J6	If lights are to be 24/7 in specific area e.g. for security/fire regulation reasons, they should be high efficient LED/CFL (NOTE: need to review LUX levels in labs – eg Tyree)
1, 2	Electrical Installations	Electricity Supply	Renewable contribution	10% of forecast annual use	Incorporate PV/ /Solar/Geothermal. Business case required to determine economic viability.
1, 2	Electrical Installations	Electricity Supply	Onsite generation		Cogeneration or trigeneration. Business case required to determine economic viability.
1, 2	Electrical Installations	Electricity Supply	Energy saving		Use of voltage control to optimise supply condition.
1, 2	Electrical Installations	Electricity Supply to non-laboratory spaces	Energy saving	PF > 0.95	Use of Power Factor Correction equipment to optimise power factor
1, 2	Electrical Installations	Standby generator	Demand management		Generator controls and BMS to be configured to permit generator to be called for demand management.

OBJECTIVE	ELEMENT	COMPONENT	PARAMETER	PERFORMANCE	NOTES
1, 2	Mechanical Installations	HVAC to non-laboratory spaces	Control set-points		Cooling 24^0C+1 Heating 21^0C-1 Chilled water 8^0C (6^0C by exception for specific requirements)
1, 2	Mechanical Installations	HVAC to non-laboratory spaces	HVAC system efficiency		Evaluate other A/C technologies such as chilled beam and displacement as an alternative to VAV or CV systems. Evaluate other A/C opportunities such as chilled water storage.
1, 2	Mechanical Installations	AC	Chilled water provision	Electric Chillers COP 4-7+	If electric chillers are proposed then COP in any phase of operation not to be lower than 4 with system optimised to achieve a majority of running time at 6+
1, 2	Mechanical Installations	HVAC	Motors	J5	High efficiency and EC motors to be used for pump and fan applications. Evaluate low noise VSD's where appropriate.
1, 2	Mechanical Installations	HVAC to non-laboratory spaces	HVAC system efficiency		Evaluate passive HVAC techniques. Incorporate economy cycle and night time set-back strategies.
1, 2	Mechanical Installations	HVAC to 24/7 spaces	HVAC system efficiency		Evaluate provision of dedicated 24/7 plant for these areas to allow out-of-hours shutdown of other HVAC plant
1, 2	Electrical Installations	Metering	Coverage	As BCA and UNSW Metering Guidelines	Meters to be connected to UNSW BACNet – EMACS System
1, 2	Mechanical Installations	Heating	Water heating	Water boilers efficiency >90%	High efficiency gas boilers with flue gas heat recovery

OBJECTIVE	ELEMENT	COMPONENT	PARAMETER	PERFORMANCE	NOTES
1, 2	Mechanical Installations	DHW	Water heating		No hot water supply to toilet hand basins unless required in laboratory spaces or showers
1, 2	Mechanical Installations	Water Supply	Non potable water	Bore water to be used	Flush to WC and urinals (waterless urinals are not a preferred solution), laboratory non-potable water and cooling towers if applicable.
1, 2	Mechanical Installations	Water Supply	Water conservation	Rainwater percolation	Return rainwater to UNSW aquifer recharge system
1, 2	Plumbing	Taps and Fittings	Water efficiency		Unless justification is provided, the following WELS ratings must be met for plumbing equipment: Toilets – TBA Hand basin taps – TBA Showers – TBA
1, 2	Recycling	Demolition and Construction Waste	Recovery/Reuse	At least 80% by weight to be reused/ recycled	Excluding contaminated materials

OBJECTIVE	ELEMENT	COMPONENT	PARAMETER	PERFORMANCE	NOTES
4	Materials Selection	Generally	Toxicity	No impact to occupants' health	Where comparable and low-toxicity alternatives exist, their use must be considered and justification provided for the use of more toxic products. (Examples include preferential use of low-VOC products including paints, adhesives, sealants, carpets, flooring and fit-out items, and low/zero formaldehyde content of engineered wood).
2, 3	Materials Selection	Generally	Recycled content	Resource conservation	Where comparable, cost-effective materials with a recycled material content
1, 2	Materials Selection	Generally	Embodied energy	Resource conservation/ greenhouse gas emissions' minimisation	

A few notes for further consideration

1 Metrics

- KPI – energy, kWh (or GJ) per m2 of gross internal area per annum
- KPI – emissions, kg CO2 per m2 of gross internal area per annum
- KPI – water, ML per person (FTE) per annum or ML per m2 of gross internal area per annum,
- KPI – waste, m3 general waste per person
- KPI – recycling, m3 recyclable waste per person
- Acknowledgement of Green Star, BREEAM, LEED, etc principles

2 Renewables

- Solar water heating integrated into north facing façade and roof rather than a bolt on afterthought
- Use of north façade for space heating in winter and solar chimney in summer (i.e. a building integrated solar collector)
- Micro-hydro systems, with rainwater collected on the roof to drive turbine on the ground
- PV integrated into north facing façade and the roof rather than a bolt on afterthought

3 Basic Design - Structure

- If a large thermal mass structure and envelope is design intent then evaluate against a very high thermal insulation alternative.
- Very low U-value glazing (e.g. triple glazing with low-e glass) and fenestration in conjunction with high acoustic performance.
- Very low air infiltration/exfiltration envelope.

4 Basic Design for Environment

- Selection of materials and construction methods for reusability/recoverability at end of life of building
- Low carbon content materials vs low environmental impact materials
- Design for deconstruction and reuse
- Design for minimum impact during construction (energy, water, waste, etc)
- Need to consider how students and staff will travel to work, integration of the building with transport options as far as possible, limitations on parking etc.

5 Basic Energy Efficient Design – Mechanical

- Pipe and Duct work – large cross-section, short lengths, minimal bends or junctions and limited flexible ducts to reduce pump and fan power requirements
- Proximity of source and termination for high pressure duct runs
- Very high thermal insulation to pipe and duct runs
- Comprehensive BMS installation
- Separate humidity control of OA for humidity-constrained areas
- Separation of latent heat and sensible heat treatment
- Energy / Heat reclaim (air-to-air, water-to-air, water-to-water)
- Preference for the incorporation of passive solutions

• Use of ground water (e.g. ground source heat pumps) for heat rejection or for "free cooling"
• Chilled water and/or ice storage for cost in use economy and UPS. Note: potentially high maintenance requirements

6 Basic Energy Efficient Design - Electrical

• Cabling – large cross-section, short lengths, to reduce resistive losses
• Lighting – preference for daylight plus solar tubes or solar fibre optics for deep and internal spaces. Preference for automatic control via sensors.
• Equipment – Preference for the higher efficiency options

7 Labs

- See USA EPA - Laboratories for the 21st Century:
    - An Introduction to Low-Energy Design
    - Manifolding laboratory exhaust systems
    - Optimizing laboratory ventilation rates
    - Metrics and bench marks for energy efficiency in laboratories
- Lawrence Berkeley National Laboratory
    - Energy Use and Savings Potential for Laboratory Fume Hoods

8 Option Evaluation

• Need to carry out a "fast-fail" evaluation of options to discount those that have no merit in developing – e.g. being a restricted city site there is no possibility of constructing a major wind farm on-site for renewables generation.